We claim:

1. A diode-structure diamond ultraviolet light-emitting device, said device comprising a p-type semiconductor layer formed of diamond crystal, and an n-type semiconductor layer formed of diamond crystal, said device emitting light when excited by current injection, and wherein the free exciton recombination radiation is dominant.

2. A diode-structure diamond ultraviolet light-emitting device according to claim 1, wherein said the free exciton recombination radiation being dominant refers to a state where the intensity of the free exciton recombination radiation is at least two times or more greater than the intensity of radiation caused by impurities or defects, in the range where the wavelength of the current injection emission spectrum is 300 nm or smaller.

3. A diode-structure diamond ultraviolet light-emitting device according to claim 1 or claim 2, wherein said diode-structure diamond ultraviolet light-emitting device comprises a pn junction.

4. A diode-structure diamond ultraviolet light-emitting device according to claim 1, 2 or 3, wherein both said diamond crystals are high-quality crystals including only a minute amount of impurity other than the dopant.

5. A diode-structure diamond ultraviolet light-emitting device according to claim 1, 2, 3 or 4, wherein said n-type diamond crystal is a diamond crystal doped with phosphorous.

SUB A2

6. A diode-structure diamond ultraviolet light-emitting device according to claim 1, 2, 3 or 4, wherein said n-type diamond crystal is a diamond crystal doped with sulfur.

7. A diode-structure diamond ultraviolet light-emitting device according to any one of claims 1 through 6, wherein said n-type diamond crystal is a diamond crystal grown by the chemical vapor deposition method.

8. A diode-structure diamond ultraviolet light-emitting device according to any one of claims 1 through 7, wherein said p-type semiconductor diamond crystal is a diamond crystal doped with boron.

SUB B1

9. A diode-structure diamond ultraviolet light-emitting device according to claim 8, wherein said boron-doped diamond crystal has a boron concentration of 100 ppm or smaller.

SUB A3

10. A diode-structure diamond ultraviolet light-emitting device according to any one of claims 1 through 9, wherein said p-type semiconductor diamond crystal is a crystal synthesized by the high temperature and high pressure synthesis method.

SUB B1

11. A diode-structure diamond ultraviolet light-emitting device according to claim 10, wherein said high-temperature and high-pressure synthetic diamond crystal is synthesized by adding a nitrogen remover to the flux.

12. A diode-structure diamond ultraviolet light-emitting device according to any one of claims 1 through 9, wherein said p-type semiconductor diamond crystal is a diamond crystal grown by the chemical vapor deposition method.

SUB A4

13. A diode-structure diamond ultraviolet light-emitting device according to any one of claims 7 through 12, wherein said diamond crystal grown by the chemical vapor deposition method is a homoepitaxial film grown homoepitaxially on a diamond crystal substrate.

14. A diode-structure diamond ultraviolet light-emitting device according to claim 7, claim 12 or claim 13, wherein said diamond crystal grown by chemical vapor deposition method is a diamond crystal film grown by the microwave plasma-assisted chemical vapor deposition method.

15. A diode-structure diamond ultraviolet light-emitting device according to any one of claims 1 through 11, said device comprising a p-type semiconductor diamond crystal synthesized

by the high temperature and high pressure synthesis method, and a n-type diamond crystal grown on said p-type semiconductor diamond crystal by the chemical vapor deposition method.

SUB A4

16. A diode-structure diamond ultraviolet light-emitting device according to any one of claims 1 through 9 or claims 12 through 15, wherein a first diamond crystal grown by the chemical vapor deposition method is formed on a diamond substrate, and a second diamond crystal grown by the chemical vapor deposition method is further formed thereon.

SUB B1

17. A diode-structure diamond ultraviolet light-emitting device according to claim 16, wherein said first diamond crystal grown by the chemical vapor deposition method is either a p-type semiconductor diamond crystal or an n-type semiconductor diamond crystal, and said second diamond crystal grown by the chemical vapor deposition method is either an n-type semiconductor diamond crystal or a p-type semiconductor diamond crystal that differs from the first diamond crystal grown by the chemical vapor deposition method.

SUB A5

18. A diode-structure diamond ultraviolet light-emitting device according to claim 16 or 17, wherein said second diamond layer grown by the chemical vapor deposition method is grown selectively on said first diamond layer grown by the chemical vapor deposition method.

SUB A5 cont.

19. A diode-structure diamond ultraviolet light-emitting device according to claim 16, 17 or 18, wherein an electrode is formed on the exposed surface of said first diamond layer grown by the chemical vapor deposition method.